



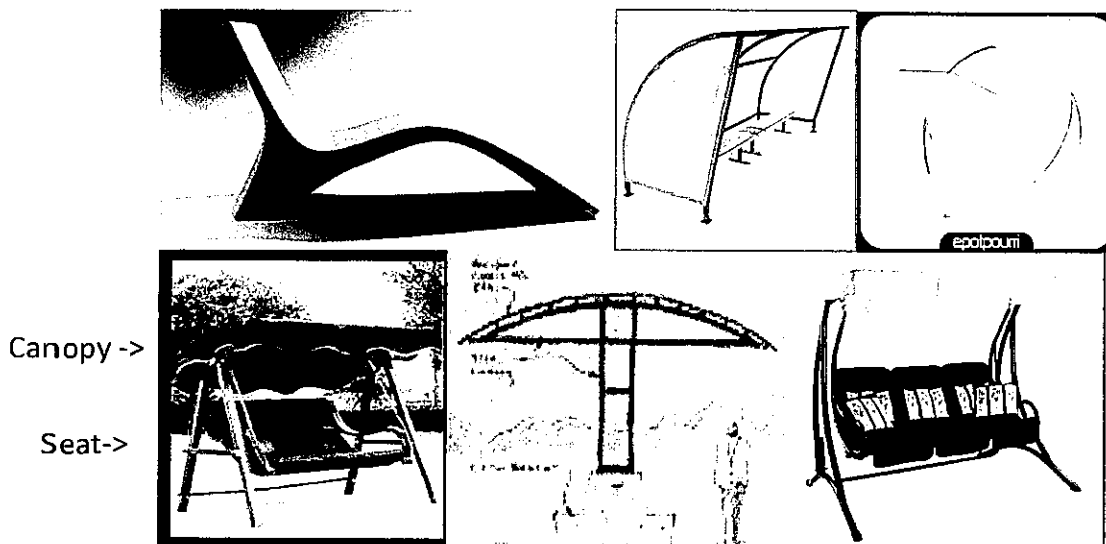
ASSESSMENT TASK

The water front bench

Subject:	Y10 Standard Mathematics	Name	Kristy Fung
Topic:	Polynomials	(Class):	(4) 10Joy
Date of task assigned:	22 nd September, 2011	Reading material:	Chapter 2 & 6 in Book A
Due	6 th October, 2011	Date:	
Submission of task:	Please submit a print copy of the assessment to your Maths teacher on or before Thursday, 6 th October 2011 at 0840.		

This task assesses Criteria A, C, & D.

Task Brief: Design a water front bench with a canopy.

**ADVICE:**

Read the criteria descriptors and task-specific rubrics carefully before you start your work. This will give you a clear understanding of what is required and what a high quality piece of work for this task must include.

This way you give yourself the best chance of achieving the highest levels in this task.

Please attach this sheet to your final report.

- Comfort
- canopy, armrest, legs
- rain direction.

The Task

Background

You have been hired as a new designer at the *Polynomial Seating Company (PSC)*. The company is world famous for designing and manufacturing creative and attractive seats and benches, mainly for outdoor use. The Manager is giving you a special task for a new client.

You are given the task of designing a chair/bench for use outdoors. The client wants your designs quite quickly. So does the manufacturing department of PSC, as they will want to start production quite soon.

The bench should be (a) comfortable, (b) suitable for keeping off the sun and the rain and (c) have a profile that is highly mathematical in shape – in fact it should use functions that you have met in this topic of Polynomials (i.e. quadratics).

Of course, you won't **build** the bench, but you will come up with the functions (equations) that will define the shape of the bench.

You will submit a report that outlines the development of your design. The report will be assessed using MYP Assessment Criteria A, C and D, and the paragraphs below expand on this.

Criterion A:

Here you show your **knowledge and understanding** of quadratic equations and their graphs. You **MUST** provide all the appropriate information about your design specification including:

- Accurate plots of all graphs, showing the important features of the design;
- Sets of equations describing all curves used and listing the range of x-values;
- The process (mathematics) by which you came up with the equations used in the design including possible modifications that could be made if requested by the client.

In order to score top marks in this criterion, you should show how you have used your knowledge in **unfamiliar situations** by embedding and developing at least one function that has not been covered in class, such as a cubic.

Criterion C:

Your design needs to be **communicated** effectively for your manager, the client, and the manufacturing department who will use it to make the actual bench. This means that all graphs will be clearly labeled, and all appropriate diagrams and charts will be explained. Equations will have to connect sensibly to appropriate units of distance.

Any software used will have to be cited and, if necessary, explained.

Criterion D:

Before you begin your design, it is important that you come up with a set of specifications so the client can see how comfortable, sheltered, and creative your design will be. You need to **reflect** (and possibly research) on associated real-life issues, such as:

- People's sizes and comfort levels;
- How people sit or lounge;
- How the sun and the rain act;
- How easily the bench might be stored away;
- Any other features that you believe may be relevant to the product.

Once you have finished your design, please **evaluate** it against the specifications you listed before you began. Consider how well your model fits your specifications by checking the degree of accuracy (possibly percentage error or sig. fig.). Because the client wants the initial design in just a few days, there may well be a number of things you cannot do. If you had more time, suggest what other things you might do to improve your product? What different mathematical methods might you have tried?

Assessment Criteria for Y10 Standard Maths Bench Assessment

Criterion A		
Levels	Task-Specific Rubric	Official IB Descriptors
0	The student does not reach a standard described by any of the descriptors given below.	
1-2	The student generally makes appropriate selections of one or more simple functions (such as $y=mx+b$, $y=x^2$) and manipulates them in to form a chair/bench.	The student generally makes appropriate deductions when solving simple problems in familiar contexts.
3-4	The student generally makes appropriate selections of two or more non-linear functions (eg quadratics) and manipulates them to form a chair/bench.	The student generally makes appropriate deductions when solving more complex problems in familiar contexts.
5-6	The student generally makes appropriate and accurate selections of three or more functions (eg a mixture of linear and quadratic) and manipulates them to form a chair/bench with a canopy.	The student generally makes appropriate deductions when solving challenging problems in a variety of familiar contexts.
7-8	The student consistently makes appropriate and accurate selections of four or more functions, at least one of which is an unfamiliar one (eg cubics, exponential etc) to form a chair/bench with a canopy.	The student consistently makes appropriate deductions when solving challenging problems in a variety of contexts including unfamiliar situations .

Criterion C		
Levels	Task-Specific Rubric	Official IB Descriptors
0	The student does not reach a standard described by any of the descriptors given below.	
1-2	Some very basic equations are offered and described. There are some appropriate diagrams and graphs. There is a basic narrative that describes the processes used.	The student shows basic use of mathematical language and/or forms of mathematical representation. The lines of reasoning are difficult to follow .
3-4	Equations used are generally clearly explained. Clear, accurate and relevant graphs, and/or charts and tables are provided. It is generally easy to see how these diagrams describe the development of the chair/bench design. Key vocabulary is used. Narrative is generally accurate.	The student shows sufficient use of mathematical language and forms of mathematical representation. The lines of reasoning are clear though not always logical or complete . The student moves between different forms of representation with some success .
5-6	Several graphs and diagrams are offered to show the development of the chair/bench. Graphs are accurate and detailed. Equations are provided which match the important features of the graphs. It would be possible for PSC engineers to produce the chair/bench from the diagrams. The narrative is very clear.	The student shows good use of mathematical language and forms of mathematical representation. The lines of reasoning are concise, logical and complete . The student moves effectively between different forms of representation.

Criterion D		
Levels	Task-Specific Rubric	Official IB Descriptors
0	The student does not reach a standard described by any of the descriptors given below.	
1-2	There has been a limited amount of relevant research undertaken. To some degree, the student has connected this research to the design of the chair/bench.	The student attempts to explain whether his/her results make sense in the context of the problem. The student attempts to describe the importance of his or her findings in connection to real life where appropriate.
3-4	The student has undertaken good, relevant research and has used this in the development of the chair/bench. The student has explained with justification how the design features of the chair/bench relate to real-life issues. The student tries to explain the accuracy of the equations.	The student correctly but briefly explains whether his/her results make sense in the context of the problem. The student describes the importance of his/her findings in connection to real life where appropriate. The student attempts to justify the degree of accuracy of his/her results where appropriate.
5-6	The student critically compares the final product with features identified at the design stage. Real-life issues associated with the design are developed. The student justifies appropriateness and accuracy of all equations and offers a critical review of the mathematical methods used, suggesting viable alternatives or improvements where appropriate.	The student critically explains whether his or her results make sense in the context of the problem. The student provides a detailed explanation of the importance of his/her findings in connection to real life where appropriate. The student justifies the degree of accuracy of his/her results where appropriate. The student suggests improvements to his/her method when necessary.

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In question 1, we can see that all the people choose to have a two seated bench which it is obvious a two seated bench save up spaces but at the same time allow you to bring along someone with you. Therefore i'm going to make a two seated bench.

For the material of the chair i am going to use plastic since it is a strong material and also it is very easy to clean due to the bench is design for outdoor so there will be rain anytime. But then for the canopy is going to be made by water proof cloth like an umbrella for easy storage.

There's loads type of outdoor benches but according to my research and survey most people will not only want it to be decorative but also will be able to block sun and rain. Due to the opinion i had decide to add a canopy to my bench.

Bright tone color is very eye catching which is good for outdoor to attract people eye. I believe that no one would want their outdoor bench in cold tone color, over half the number of the survey want their bench to be in yellow color. And i am going to make it yellow because it is eye catching and it is a color that suit both female and male.

The use of the bench is mostly to seat on but to make it more relaxable i won't design it pin straight but with a little bit curve so that whoever sitting on the bench will be able to lean on it but will also be able to see what is happening in front of them. Which family will need to if they have any children it will be excellent if they are allow to look after them while the parents are having a break.

Because it is an out door chair so that mainly their will be children playing around or will be moving around. It will be very dangerous to have pointy edge, so i will have the chair in round edge so people will be safe on it or near it. As a designer it is very important to consider about the costumer safety and the attractiveness of the product.

Evaluation of the survey:

As i am concluding my survey i figure out that most of the answer of the question is quite obvious. Which immediately help me to decided what elements and consideration i need to add in to my design.

But then in some question people will tick more than one answer although i didn't ask them to, so i would need to give instruction more clearly to get more specific results.

DESIGN SPECIFICATION

Essential criteria

1. Use bright and eye catching colors

According to the research customer go for bright tone color then cold tone color. Since eye catching will cause more people to buy it. Sharp color will also lower the chance of injury.

2. Use plastic as material

Plastic is easy to clean for and also very light for storage since it is a outdoor bench. Plastic is also hard enough for outdoor

3. Round edge and corners

It is an important factor for customer that have children to prevent them from getting hurt all edge would need to be round.

4. Have a canopy

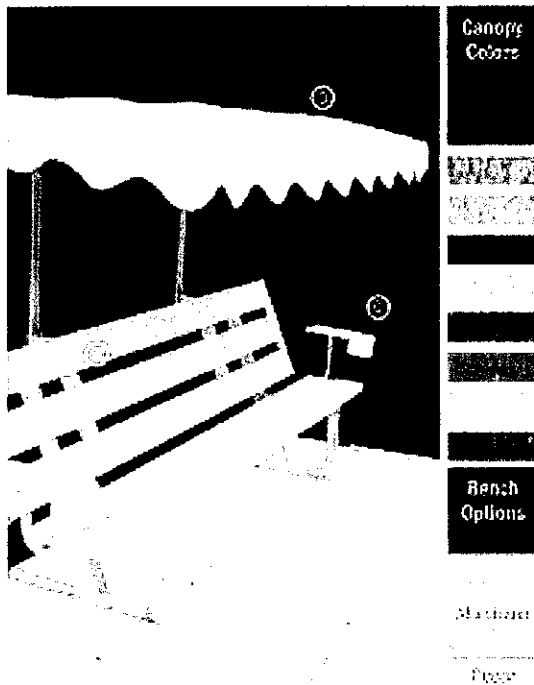
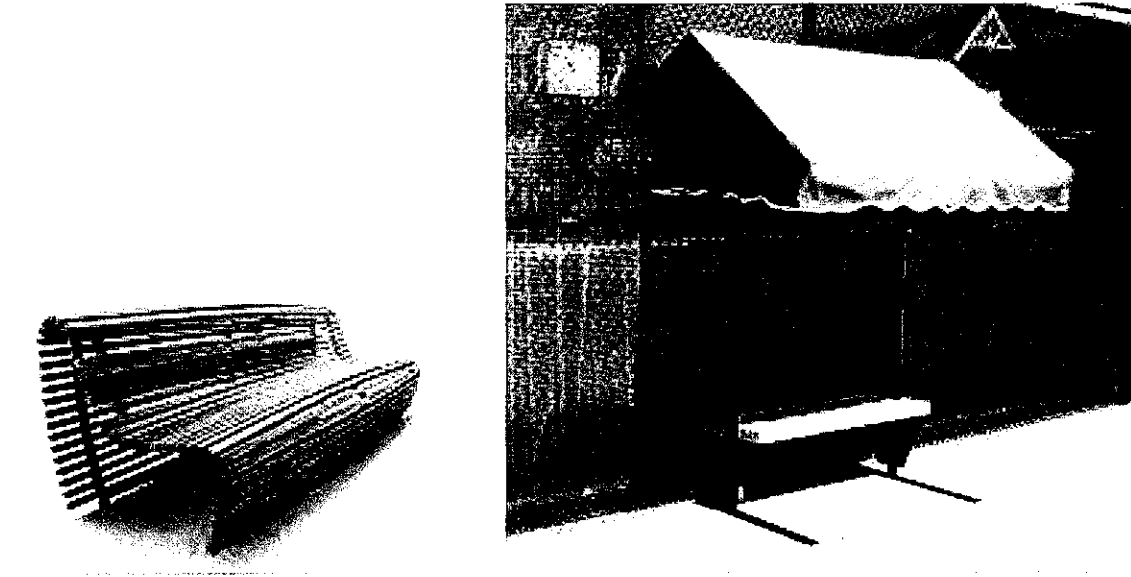
Be able to protect and consider about the bench being outdoor it would be more considerate to have a canopy from blocking sunlight or rain.

DESIGN BRIEF

In this design task, i am going to make a outdoor bench according to my client's need. They need the bench to be outdoor therefore material that are easily clean and store will be the first choice. The theme will basically be bright color since it is eye catching and can attract customer. The important consideration of this task is safety for client that have family. It is also very important that the function of the bench is clearly understand for company to make it out. It's price range will be around few hong kong dollars since i am not using any expensive material.

RESEARCH

Different types of outdoor benches:



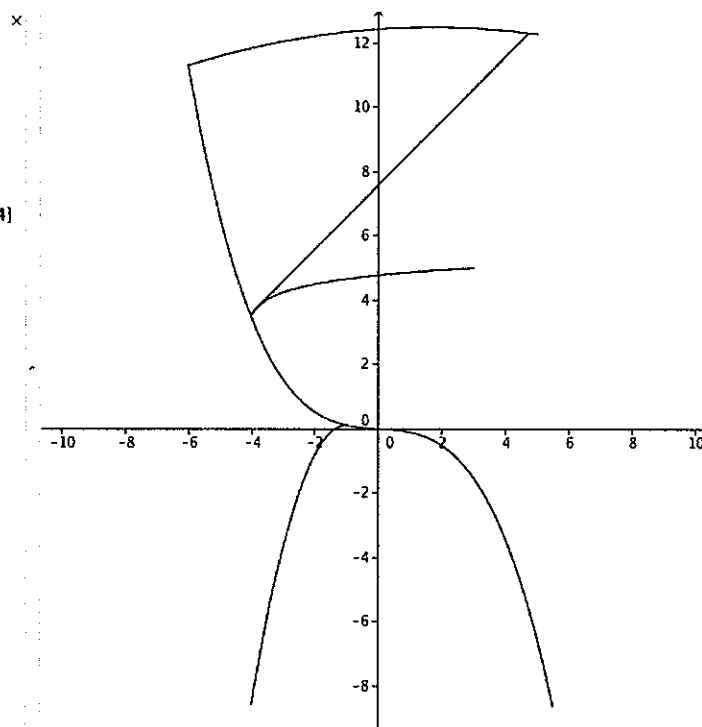
BENCH FUNCTION EQUATION

Free Objects

- $f(x) = -(0.05)x^3 - 0.06x$
- $g(x) = -(x + 1.55)^2 + x + 1.55 - 0.14$
- $h_1(x) = \lg(x + 4.25) + 4.15$
- $p(x) = x + 7.6$

Dependent Objects

- A undefined
- $p_1(x) = \text{If}[x < 5 \wedge x > -6, -(0.02)(x - 1.7)^2 + 12.5]$
- $q(x) = \text{If}[x < -1 \wedge x > -4, -(x + 1.55)^2 + x + 1.55 - 0.14]$
- $r(x) = \text{If}[x < 4.7 \wedge x > -4, x + 7.6]$
- $s(x) = \text{If}[x < 3 \wedge x > -4, \lg(x + 4.25) + 4.15]$
- $t(x) = \text{If}[x < 5.5 \wedge x > -(6.03), -(0.05)x^3 - 0.06x]$



In this bench design i had totally used five equation which includes the canopy, main body, handle, legs and the stick to support the canopy.

1. For the main part the function is $y = -0.05x^3 - 0.06x$

then i cut it by $x < 5.5$ and $x > -6.03$ i cut it just because of getting the same length as the other leg and to match with the canopy.

2. The leg is originally $y = -x^2 + x + 2$ then it turn out to be $y = -(x + 1.55)^2 + x + 1.55 - 0.14$ because i move its position and i cut it by $x < -1$ and $x > -4$ so that it would go in well with the bottom of the seat.

3. The handle of the chair is $y = \log(x)$ then it turn out to be $\log(x + 4.25) + 4.15$ since i move it to the position that touches the chair. Then i cut it by $x < 3$ and $x > -4$

4. The stick is mainly just a straight line that support the canopy to the bench since without the stick the canopy will easily and the design is that the canopy is made out of cloth so there is need to support it with a stick.

The equation of the stick is $y = x$ it turns out to be $y = x + 7.6$ and i cut it by $x < 4.7$ and $x > -4$.

5. Lastly the canopy is $y = -(0.02)(x - 1.7)^2 + 12.5$ and i cut it by $x < 5$ and $x > -6$ the canopy is a bit longer than the chair and the curve of it will block rain from different direction.

EVALUATION

Since i only have a short period of time to design the chair but then i think i that i have satisfy by achieving the specification that i set for this task early before i start designing. I have use yellow as the color of the outdoor bench which is a bright color and it also match female and male so that the client of mine can use it with the family. I have also follow all my specifications by choosing plastic as the material , have round edge to prevent injury and also having a canopy.

If i have more time to improve my product i would try to improve the equation by making the line more smooth together. I would also add more function on the bench since i know that there are more kinds of functions i have add in a simple log function in this equation this time but then i hope that i will add in more for example the $f(x)$ function and \sin, \cos, \tan .

I would also make it more relevant to real life for example the rain direction and also how to make this outdoor bench usable for all four season especially in winter.

SURVEY

To help me getting an idea of what kind of benches is suiting the target market, trend, and also the needs and consideration from my clients. I am going to make a survey for different people in the society mainly to understand more on the need to design an outdoor chair also to gather more information which may inspire and improve me on designing the outdoor chair.

Heres the template of the survey:

Hello everyone, i am Kristy Fung a designer of Polynomial Seating Company. I am recently working on a designing task to design chairs for the outdoor. To help me get a better idea of the needs for a adult and also family member i wish that i can have a better concept after getting different opinion from the current market.

1. How many seat/s will you prefer in your water front bench?

1 () 2 () 3 () 4 ()

2. What kind of material will you use to make your bench?

plastic () wood () metal () cloth ()

3. What is the main purpose you would like to have in a outdoor bench? (may choose more than one)

decoration () to block sun and rain () relaxation ()

4. What color would you prefer for an outdoor chair?

yellow () red () blue () hot pink () lame green ()

5. What will the position that you usually are on the bench ?

sitting () lying ()

6. Which of the following you think should be consider while designing my chair?

Safety () color () purpose ()

Thanks for your participation :D !!!!

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1. How many seat/s will you prefer in your water front bench?

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yellow () red () blue () hot pink (✓) lame green ()

5. What will the position that you usually are on the bench ?

sitting () lying (✓)

6. Which of the following you think should be consider while designing my chair?

Safety () color (✓) purpose (✓)

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SURVEY ANALYSIS

Survey results:

1. How many seats

	1	2	3	4
Results	0	5	0	0

2. Materials kind

	Plastic	Wood	Metal	Cloth
Results	4	0	0	1

3. Purposes

	Decoration	Block sun/ rain	Relaxation
Results	5	5	2

4. Color

	yellow	red	blue	hot pink	lame green
Results	3	1	0	1	0

5. Position

	Sitting	Lying
Results	4	1

6. Consideration

	Safety	color	purpose
Results	3	2	2

Analysis:

This analysis is sorted by question.

